MONOGRAPH SERIES

ON

'ENGINEERING OF PHOTOSYNTHETIC SYSTEMS'

VOLUME 4

BIODYNAMIC GARDENING

AUGUST 1980

PREFACE

The Biodynamic/French intensive method of growing vegetables first came to our attention through the work of John Jeavons and Ecology Action of the Mid-Peninsula, Palo Alto, CA, USA. His book in two editions: "How to grow more vegetables" (1979), Publisher: Ten Speed Press, P.O Box 7123, Berkeley, CA 94707, USA, has been our standard reference and should be consulted as background material.

From Jeavons' experience and our own experience of two and a half years in rural areas we can unequivocally state the following conclusion: This method can be transferred to very disadvantaged families owning small, poor strips of land. The yields are very promising and can serve as a valuable source of nutritional and economic augmentation.

This monograph gives our methods of biodynamic gardening adapted to our soils. It has been written with the purpose of transferring a very simple, energy conserving technology to Harijan families. It is written in two languages.

The staff who have worked on this project with great dedication and perseverance are:

Annadurai
Balaraman
Dhanasekharan
Elumalaiyan

Govindan
Jayaraj
Jayaraman
Keshavaraj
Krishnamurthi
Mani (S.K)
Mani (Panaiyur)
Manoharan
Nalini Keshavaraj
Narayanaswamy
Paranthaman
Palaniswamy
Perumal
Radhakrishnan
Raju
Ravi Seshadri
Subbiah
Thulukkanam
Venkataramani
Vinayakam etc etc

plus all villagers who had gardens.

As always we are very grateful to Sri M V Murugappan and the Board of Governors for the wonderful encouragement given to our work. The International Federation of Institutes for Advanced Study - Stockholm has sponsored a small part of this work for which we are grateful.

C V SESHADRI

:

PRINCIPAL CONCLUSIONS

1. This method can be taught to people with no previous experience of vegetable growing.

2. They can produce good yields with locally available resources in poor soils.

3. They can become self-reliant and self-confident after very little training.

THE METHOD AS GIVEN IN THE BOOK

The details of the method are given in the book of Jeavons based on his experience and that of others. There is also an extensive bibliography. A summary of the important factors to be considered in the preparation of vegetable beds is as follows:-

1. Soil Preparation:

The beds are prepared in such a fashion that the roots are well aerated and the bed has the capability of sustaining, healthy, prolonged growth with minimum effort. The beds are raised from the ground and are laid out geometrically such that a person can reach the centre of the bed from both sides.

2. Soil Fertility:

The only added nutriments come from organic manure or compost obtained from natural sources. Other fertilizers may be bone meal, wood ash, etc. No synthetic fertilising elements are added for their own sake.

3. Soil Watering:

A minimum of watering is needed because the close planting creates a natural miniclimate which is humid and retains moisture in the soil. It is claimed that water requirement is very much below that of conventional agricultural practice.

4. Planting:

Very close planting with geometric spacing with or without companion plants is advocated. This is to ensure

shading the soil to prevent weed growth and for water conservation. Companion planting refers to the fact that such plants should be grown together in the same bed that can augment each others nutriment demand e.g. legumes and other vegetables.

5. Plant Health:

As a result of choosing such plants to grow together that can keep each other healthy, insect attack is minimised. Also plants can be chosen to actively repel insect attack.

6. Planting Operations:

Operations such as sowing of seed, transplanting, encouraging leaf and root growth are synchronised with the phases of the Moon.

7. Harvest and Post- harvest:

Non-edible matter is returned to the soil. Successive preparations of the beds are less labour and time consuming due to constant soil improvement. Some indications of this kind of gardening compared to traditional or modern agriculture are as follows:-

a) Yields: Average 4-6 times U.S. average and range upto 31 times.
b) Water use: 1/8 - 1/2 of commercial crops.
c) Cultural Energy Inputs: 1/100 of commercial agriculture. In other words, this kind of gardening is readily adaptable to the poorest families in rural areas. It is a self-reliant way of increasing food production.

EXPERIENCE AT THE CENTRE

1. The Centre has been working on these techniques for about 3 years.

2. One urban location, Tharamani, and several village locations, Injambakkam, Panaiyur, Vettuvankanni, Sholinganallur, and Injambakkam Kuppam were chosen as sites.

3. The urban site had heavy clayey soil, and the remaining sites were sandy with no clay or impervious material. In fact the last site named above was barely 50 metres from the ocean.

4. Most of the families were of Harijan background. Their formal level of education was usually non-existent and at best middle school.

5. The Centre had successes and failures and they are reported here. The method has motivated several families to try and augment their own vegetable supplies: the demand for more gardens is constantly growing.

This monograph explains the method as practised locally, lists the data obtained and recommends some suggestions for the future.

HOW WE PREPARED SANDY SOILS (See Figures 1-5)

1. First mark the plot with small sticks and string. The plots may be any length but usually 5 feet wide (1.52 m). The width includes the sloping sides of the

raised bed to be made. Leave 0.3-0.5 m between beds. Remove thorn bushes, tree stubs, etc, but you may leave grass and weeds.

2. Starting from one end add compost, manure or poultry house litter, wood-ash and any other organic matter available in a thin layer on top. The amounts added are given in the examples shown. Wood ash, bone meal, etc. are particularly useful to provide good mineral nutriment. Wet biogas effluent slurry is useful for clayey soils; in sandy soils semi-solid manure or effluent is better.

3. A good mammutti or spade is necessary for the next part; starting from one edge dig one foot depth of soil from the edge and transfer it to a point outside on the left.

4. The next part needs a D-handled spading fork (made by TATA's). These tools are available in cities. Loosen the soil a further one foot below by moving the spading fork back and forth. Do not mix the soil layers but try to keep the original stratification. The idea is to allow air to the roots and easy nutriment access.

5. Now the first part of the bed is filled. Dig one foot into the next part of the bed and throw it into the first trench such that a raised mound is created.

6. Use D-handled fork on lower part of second trench as stated in 4.

7. Repeat 5, 6, till the end of the bed. When the last

trench is loosened with the D-handled fork, add the topsoil from the first trench kept outside on the left.

8. Build up and smoothen the bed as shown in last figure.

Special Additional Notes about Sandy Soils from our Experience

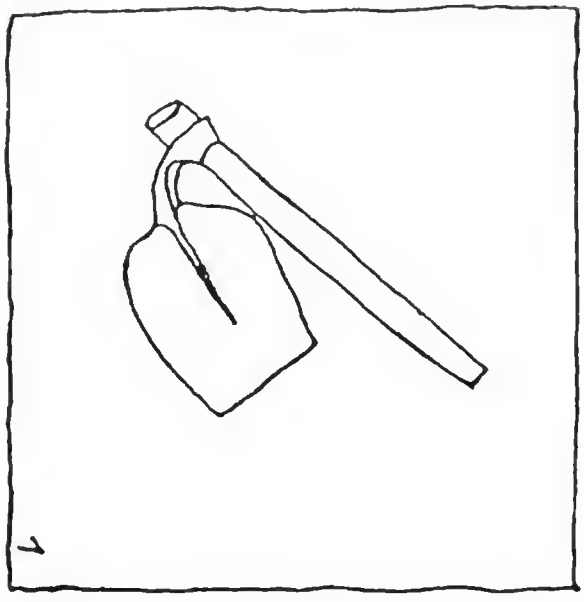
Note 1: Though sandy soils are very easy to work they are also easy to compact; therefore the beds should not be stamped or walked on. Working should be from each side after beds are complete.

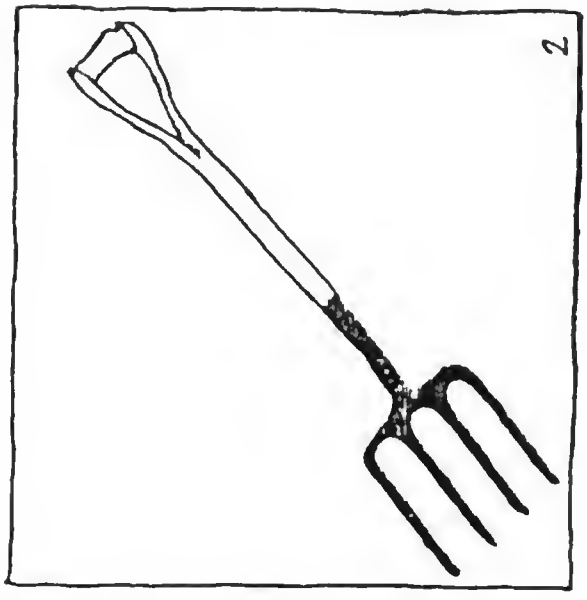
Note 2: The beds will not have a raised appearance after rain or watering but if the bed is used for successive crops, it will slowly assume the shape of a dome when looked at from the sides.

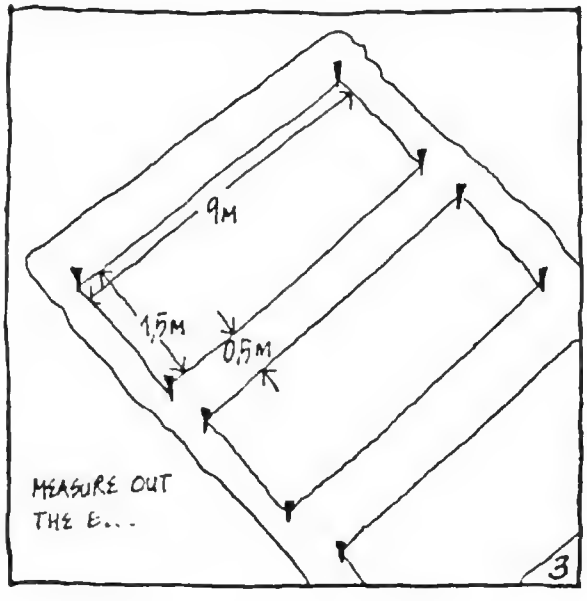
Note 3: Quite a bit of poultry litter or fish waste may be needed the first time. Successive plantings may need lesser amount, depending on the crop.

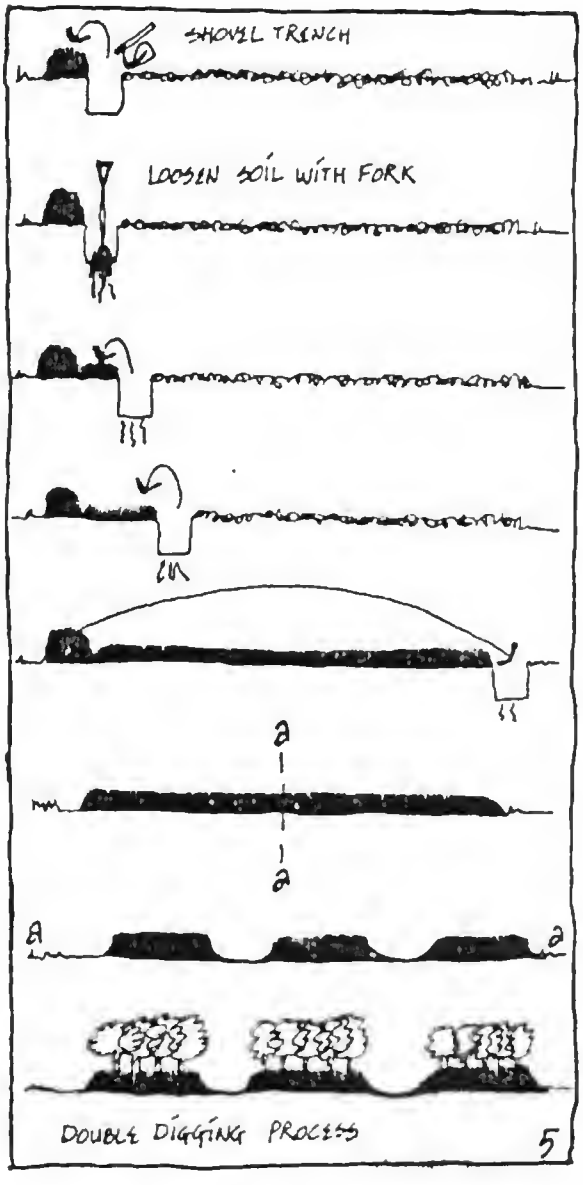
Note 4: The time needed for first preparation for a bed of about 6M x 1.5M is ½ hour to 1 hour. Subsequent preparations i.e. after the first crop is about 10 minutes. This is for sandy soil near the coast but the drastic reduction is also observed in clayey soils.

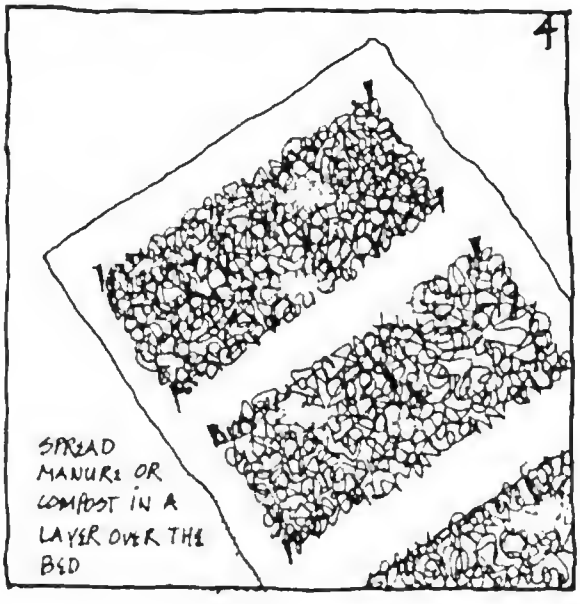
Note 5: Note 1 - 4 should reinforce the importance of keeping the same beds going in the same area for true biodynamic health. After the third round or so the area almost becomes self-sustaining.

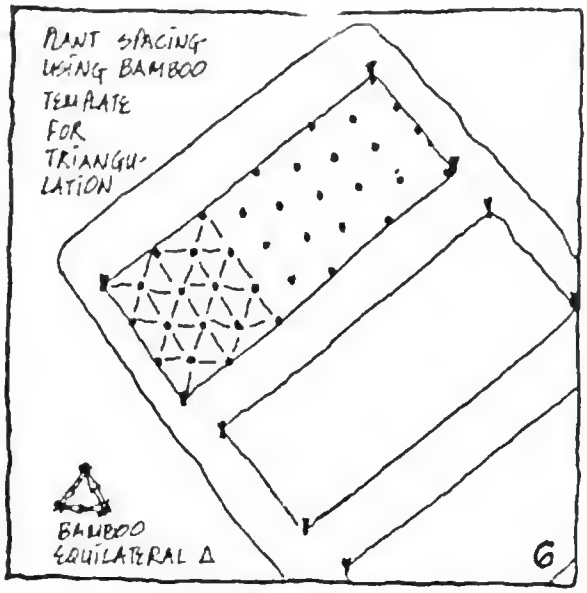

1

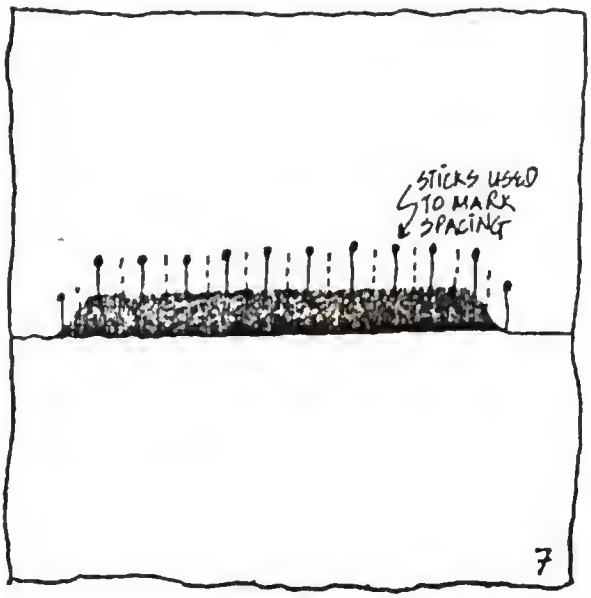

2

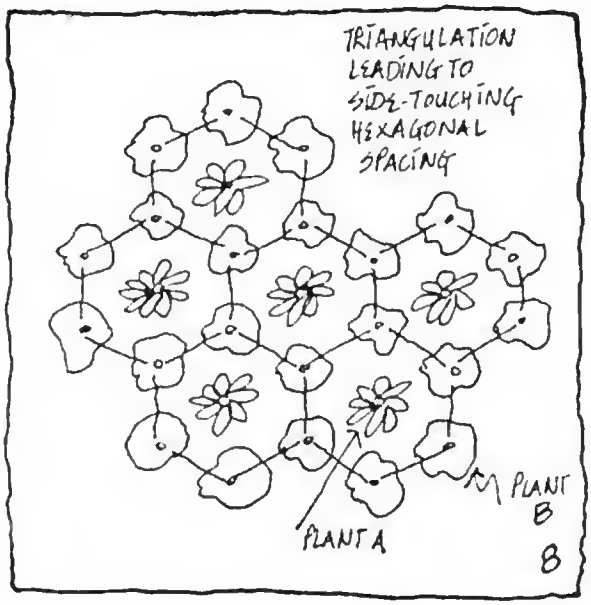

9M
1,5M
0,5M
MEASURE OUT THE E...
3

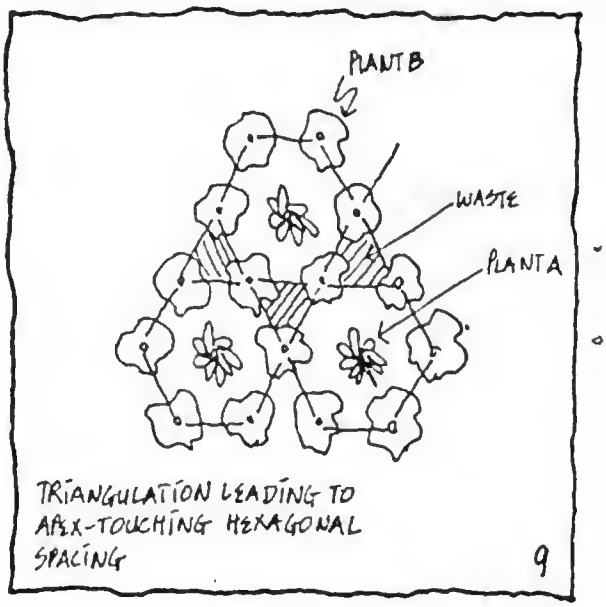

SHOVEL TRENCH
LOOSEN SOIL WITH FORK
a
a
a
a
DOUBLE DIGGING PROCESS
5


4
SPREAD MANURE OR COMPOST IN A LAYER OVER THE BED


PLANT SPACING USING BAMBOO TEMPLATE FOR TRIANGULATION
BAMBOO EQUILATERAL Δ
6


STICKS USED TO MARK SPACING
7


TRIANGULATION LEADING TO SIDE-TOUCHING HEXAGONAL SPACING
PLANT B
PLANT A
8

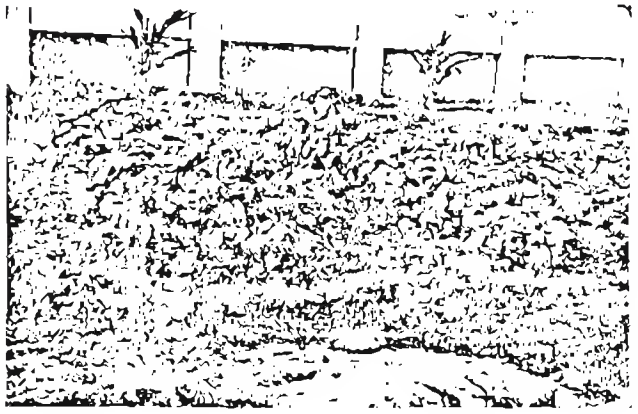

PLANT B
WASTE
PLANT A
TRIANGULATION LEADING TO APEX-TOUCHING HEXAGONAL SPACING
9

10. A double dug bed in clayey soil

இருமுறை தோண்டிய களிமண் பாத்தி

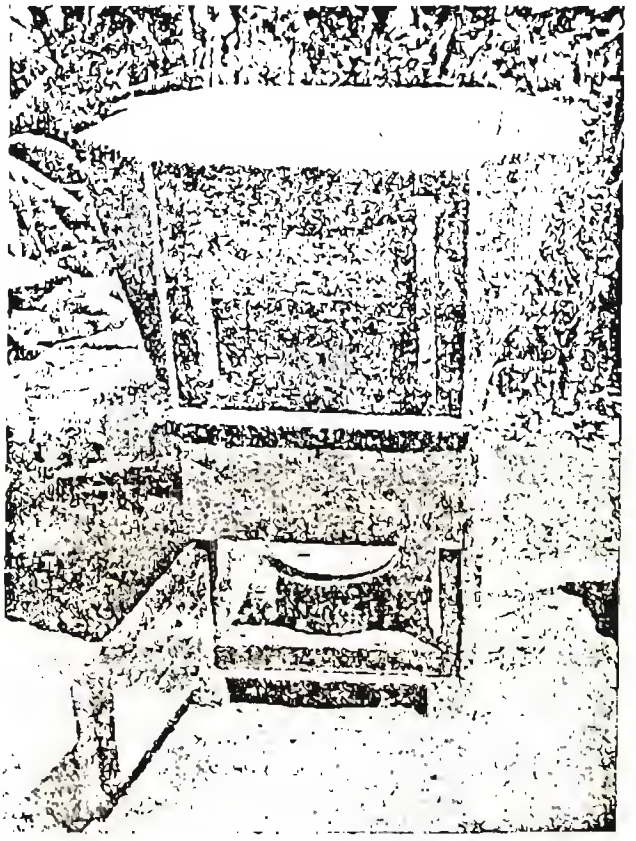
13. Bed markings in Madipakkathar's house, one of the poorest households. The triangle and marking sticks can be seen faintly

மிக எளியவருள் ஒருவரான மடிப்பாக்கத்தார் வீட்டில் பாத்திகள் அளவெடுக்கப்படுகின்றன. அளவெடுக்கும் நேர், முக்கோணக் குச்சிகளைப் படத்தில் மங்கலாகக் காணலாம்



11. Two biodynamic beds of bhendi in clayey soils, intercrop not seen

உயிரியக்கக் களிமண் பாத்திகள் இரண்டில் வெண்டை ஊடு பயிர் காணப்படவில்லை



14. Solar cookers with vessel containing neem extract

சூரிய அடுப்பில் வேப்பிலைச் சாறுடைய பாத்திரம்

12. White radish in biodynamic bed

உயிரியக்கப் பாத்திகளில் வெள்ளை முள்ளங்கி

HOW WE PREPARED CLAYEY SOILS

1. The soil being hard baked clay, give a preliminary two day soaking to wet it thoroughly.

2. Dry out partially for 2 days.

3. Loosen and weed out with a D-handled spading fork.

4. Rest soil for one day.

5. Add compost (aerobically treated water hyacinth leaves) or farmyard manure or gobar-gas (biogas) thick slurry and rest soil for one day.

6. The rest of the double-digging: Proceed after this in steps 1-8 as in sandy soil. In using the D-handled fork to loosen bottom one foot of soil, break up big clods with tines. Do not mix layers as far as possible.

Special Notes about Clayey Soils from our Experience

Note 1: The laborious procedure here given was only necessary for the first preparation. After that subsequent preparations were much easier. The soil in the beds should not be compacted and care taken to see that the side of the bed are properly watered without eroding them with too much water.

Note 2: Very clayey soil can be mixed with sand to give a somewhat loose texture. However after some time the cultivation of the beds themselves can also do this.

Note 3: In general we failed with root vegetables

(Radish etc) in sandy soils, so clayey soils are better. However, all other vegetables tried grew equally well in both types (except where severe pest damage took place).

A general soil analysis was not carried out. This may be advisable. All other information is as given in the tables accompanying the cultivation methods.

Subsequent Planting and Maintenance Operations

These operations were common to both types of soils.

a) Spacing of Plants:

Except for greens which are uniquely adapted to the coastal area and have very tiny seeds, the planting of seeds or transplantation of seedlings were done using a hexagonal matrix. Greens were sown by broadcasting the seeds.

The hexagon spacings were done by making equilateral triangles out of split bamboo poles about 2.5 cm in diameter. One such triangular template is shown in the photograph (See Figures 6-13). The hexagon method is shown in plate 8. The stepwise procedure is helpful.

Step 1: Mark bed using equilateral triangles on staggered spacing(See Figure 6). Mark corners with small sticks. Note end view of bed - slopes are also used for marking spacing (See Figures 6-13).

Step 2: There are two ways of considering the hexagonal points - either apex touching or side touching. Apex

touching is wrong and will give fewer plants. Side touching is a hexagonal close-packing system and is preferred. If plant A is the same as plant B then both methods give the same result - all points have the same plant. However, if plant A and plant B are different then the apex touching pattern will give fewer plants.

b) Planting Using Phases of the Moon:

For approximately 2-3 days on either side of the New Moon (Amavasya), the Moon and the Sun rise and set together. Hence one can consider that their respective gravitational effects augment each other. In our work, though the absolute proof cannot be presented, it appears that seeds germinate much quicker if sowing is done about 2/3 days before the New Moon. This is also reflected in obtaining shorter cultivation times.

Similarly transplanting of seedlings is done during the 2/3 days preceding the Full Moon to take advantage of the Earth's gravitational forces. (The Sun and Moon oppose each other). This helps good root growth of the young seedlings so that they can grow strong.

c) Watering Plants:

Invariably our plants have been watered by hand using a watering can (Rose can). This reduces the water consumption considerably and helps to prevent erosion. The watering is done by gently spraying plants. Jeavons book shows how some vegetables need watering at roots and some on leaves. Here such refinements were not practised.

d) Insecticide Usage:

The following insecticides have been used in the villages by the Centre.

1. Neem Leaf Extract: Young neem leaves (azadiracta indica) are cooked in water and subjected to heating in a solar cooker (Technical Notes No.1, MCRC). About 4 kg of leaves are enough to produce about 30 litres of extract. This extract (very pungent) is sprayed on leaves with a sprayer (See Figure 14).

The heating of the extract upto about 60-75°C is carried out for about 2-3 hours. Though the neem extract is very effective, at times we have no idea of its mode of working. There have been cases where the neem extract has been ineffective.

2. Other extracts used have been from Prosopis juliflora and pyrethrum. The latter is more effective than the former.

3. Villagers have used commercial insecticides which are expensive and leave leaf residues, but we have tried to discourage this and have not always succeeded. It is difficult to explain the high energy intensity of insecticide use and long term deleterious effects.

4. In general the use of insecticides is unnecessary if instructions are followed carefully and the bed kept in a good state of health.

e) General Maintenance:

Weeding can be a problem if proper plant spacing is not ensured to fully cover the bed. Also in initial stages

weeds can grow if the soil contained seeds of weeds. Weeds should be removed with their roots. This is helped by the loose soil.

Goats and chicken damage is very bad if proper fencing is not used. There is absolutely no way to prevent this unless villagers themselves act in concert and cooperate with each other. Unfortunately motivation is very difficult especially when relatives deliberatively damage each others' plots. To the best of our ability we have tried to keep them interested and self actuated to grow more vegetables.

PLANTS, COMPANIONS, SPACING AND YIELDS

1. The Research Centre has not carried out extensive trials to find the best combination of companion plants etc.

2. If Jeavons' book is any guide, it is wise to choose a few basic combinations first before trying to go for a wide variety of plants. In the work here we have been guided by the principle that only plants that are familiar to the area should be chosen, especially in the villages.

3. It is better to plant strongly flavoured plants e.g. marigold, outside the borders to keep off insects. However, onions do not grow very well with many species because of active dislike. Usually the best combination of plants seems to be a legume and another plant which is a heavy feeder e.g. tomato, egg-plant (brinjal), etc.

4. The spacing of companions is as given in the figure. The B plant is the main plant and A plant is considered the companion. There are usually 3 times a many B plants as A plants. The A plants may be chosen for their long root system, nitrogen fixing or any other key property that can help the B plants (See Figure 8).

5. The table that follows give the plants yields, energies, etc. from standard data available in the literature. The principal source for energy values and names of vegetables is "Nutritive Values of Indian Foods" by C. Gopalan, B.V. Rama Sastri, and S.C. Balasubramanian (National Institute of Nutrition ICMR, Hyderabad, India (1977)). The vegetable yields are from Tamil Nadu Agricultural Graduate's Association, Madras 600 008, (1975), (1979).

Table 1: Standard Values from Literature

Name of the vegetable	Energy kcal/kg wet	1975 yield kg/ha	1979 yield kg/ha
Tomato Lycopersicon-esculentum	230	25000	37500*
Brinjal-Egg Plant Solanum melongena	240	25000	25000
Bhendi Abelmoschus esculentus	350	12000	12000
Chillies Capsicum annuum	290	17500	17500
Cluster Beans Cyamopsis tetragonoloba (Psoroloides)	600	7500	6000
Ridge gourd Luffa acutangula	170	10000	20000
Pumpkin Cucurbita maxima	250	20000	22500
Ash gourd Benincasa hispida	100	25000	22500
White Radish Raphanus sativus	170	10000	17500
Cucumber Cucumis sativus	13	-	-
Musk melon Cucumis melo	170	-	-
Water melon Citrullus vulgaris	160	-	-
Union (Allium cepa)	590	15000	-

a) Amaranthus polygonoides (Sirukeerai)	330	-	-
b) Amaranthus gangeticus (Thandukeerai)	450	-	-
c) Amaranthus tristis (Araikeerai)	440	-	-

Notes: *1) Where the yields for different years are different, either seed rate or fertilizer input were also different. Both commercial fertilizer and insecticide were used.

2) The yields given are presumably for experimental plots under controlled conditions. It is not known whether walkways are included or excluded.

3) The energy values are not actual but calculated values.

4) These yields and energy values are used for comparison of the conventional methods and biodynamic methods.

YIELD AND OTHER INFORMATION FROM VILLAGE AREAS

The next eleven tables give yield and other information from village households. This is followed by a report from the Social Worker and a preliminary quantitative analysis of energy and yields.

Table 2: Nagalingam's House

No	Date of planting	Size of bed	Man-days or hours to prepare	Manure	Vegetable	Times harvested	Frequency of harvest	Total yield	Remarks
1	October 1979	5'x12'	½ man-hour	10kg dung	Bhendi	16	2/week	12kg Bhendi 2½kg Greens	Pesticide not effective
2	October 1979	5'x8'	½ man-hour	10kg dung	Greens	14	2/week	4 kg	Good crop, best first yield after about 25 days
3	October 1979	5'x8'	½ man-hour	10kg dung	Greens	14	2/week	4 kg	-
4	October 1979	5'x8'	½ man-hour	10kg dung	Greens	14	2/week	4 kg	-
5	December 1979	5'x18'	1 man-hour	20kg dung	Bhendi + Tomato	16	2/week	12 kg 10 kg	Very good yield
6	December 1979	5'x13'	1 man-hour	20kg dung	Brinjal	20*	4/week	12 kg	*The total period
7	December 1979	5'x9'	½ man-hour	20kg dung	Bhendi	24*	4/week	18 kg	*As reported by farmer is very approximate

Comments of farmer: Pesticides are not good; better to buy commercial pesticides. Had water problem; the total yields are as given by farmers and are not accurate. However for a first attempt the yields are good.

Table 3: Srinivasan's House

No	Date of planting	Size of bed	Man-days or hours to prepare bed	Manure	Vegetable	Times harvested	Frequency of harvest	Total yield	Remarks
1	Oct'79	5'x15'	¾ man-hours	12kg dung or waste	Green (A gangeticus	30	3/week	10 kg	Good
2	Oct'79	5'x15'	¾ man-hours	-do-	-do-	30	3/week	12 kg	Good
3	Oct'79	5'x15'	¾ man-hours	15 kg dung	Cluster beans	35	2/week	7 kg	Goat attack

Comments of farmer: Fishing people never knew vegetables/ gardening until this time. Highly satisfied.

Table 4: Vinayaka Mudaliar's House

No	Date of planting	Size of bed	Man-days or hours to prepare bed	Manure	Vegetable	Times harvested	Frequency of harvest	Total yield	Remarks
1	Oct'79	5'x16'	½ man-hour	15kg dung	Bhendi	25	1/week	18 kg	Good
2	Oct'79	5'x11'	½ man-hour	10 kg dung	Greens	30	3/week	10 kg	Very Good

Comments of farmer: Educated farmers can look after plots much better; Fencing and water supply must be adequate

Table 5: Boopalan's House

No	Date of planting	Size of bed	Man-days or hours to prepare bed	Manure	Vegetable	Times harvested	Frequency of harvest	Total yield	Remarks
1	Oct'79	5'x8'	½ man-hour	6kg fish waste	Greens	40	3/week	20 kg	
2	Jan'79	5'x10'	½ man-hour	10kg fish waste+ veg.compost	Tomato	10	1/week	4 kg	Still harvesting in April
3	Oct'79	5'x12'	½ man-hour	10kg fish waste+ veg.compost	A.gangeticus (Greens)	30	everyday	15 kg	
4	Oct'79	5'12'	½ man-hour	10kg dung +waste	Beans		Pest attack		

Comments of farmer: Boopalan's wife looked after complete plot. This plot is only 50 m from ocean edge. Gardening outstanding success; did not buy vegetables at all during this period. Now wants fruit trees, chillies, brinjal, etc.

Table 6: Balammal's House

No	Date of planting	Size of bed	Man-days or hours to prefare bed	Manure	Vegetable	Times harve-sted	Frequ-ency of harvest	Total yield	Remarks
1	Oct'79	5'x12'	½ man-hour	10kg dung +ashes	Greens	25	½/week	10 kg	
2	Oct'79	5'x12'	½ man-hour	10kg dung +ashes	Greens	25	½/week	10 kg	
3	Oct'79	5'x12'	½ man-hour	15kg dry dung+ ashes	Cluster beans	50	almost everyday	15 kg	Very Good yield
4	Oct'79	5'x12'	½ man-hour	15kg dry dung+ ashes	Bhendi	8	2/week	2 kg	pest attack

Comments of farmer: Very satisfied with this method; first time they grew vegetables on sandy soil. Man folk are fisher-men, so no experience with horticulture.

Table 7: Veeramuthu's House

No	Date of planting	Size of bed	Man-days or hours to prepare bed	Manure	Vegetables	Times harvested	Frequency of harvest	Total yield	Remarks
1	Oct'79	5'x16'	¾ man-hour	15kg dry dung	Greens	35	2/week	25 kg	
2	Oct'79	5'x16'	¾ man-hour	15kg dry dung	Greens	35	2/week	25 kg	
3	Oct'79	5'x16'	¾ man-hour	15kg dry dung	Bhendi	35	3/week	17 kg	
4	Oct'79	5'x16'	¾ man-hour	15kg dry dung	Cluster Beans	15	1/week	8 kg	Pest attack
5	Oct'79	5'x16'	¾ man-hour	15kg dry dung	Bhendi	35	3/week	15 kg.	

Comments of farmer: Never believed it was possible so near the ocean. Seeing vegetables in fishing village for the first time. Very grateful to MCRC.

Table 8: Chelliah's House

Comments of farmer: Jan'79 planted a few beds which by and large failed due to poor maintenance, inadequate water, and goat grazing. However, farmer convinced of the value of the method.

Table 9: Ethiraj's House

Comments of farmer: Cluster beans was the only crop obtained from a small bed satisfactorily. Others failed completely due to pest attack, goat grazing, etc.

Table10: Valli's House

Comments of farmer: Greens obtained in very good yield. Others failed due to goat grazing and pest attack. Severe water problem.

Table 11: Kannappan's House

Nov'79	1. Prepared 7 beds of approximately 5'x10' each with 5 kg poultry litter bed. Planted with Bhendi. Cost of seed material Rs.4/=; Yield:51 kg. Return on sale Rs.102/=. Water usage about 15 litre/bed/day.
Nov-Dec'79	2. Prepared 6 beds of approximately 5'x11' each with 5 kg poultry litter per bed. Planted with greens (A gangeticus, tristis and polygonoides) Cost of seed material Rs.4/=; Yield 31 kg of tristis and polygonoides at Rs.1/kg. Yield of 66 bundles (250 gm/bundle) of A.gangeticus at 0.50 p each. Total value Rs.47.50.
Nov-Dec'79	3. Prepared 11 beds of 5'x8' each with 3-5 kg of poultry litter per bed. Planted cluster Beans. Cost of seed: Rs.5/=. Total yield 16 kg (beds were still yielding). Value Rs.48/=.
	4. Prepared 3 beds of 5'x10' each with 5 kg of poultry litter per bed. Planted with cowpea. Cost of seed: Rs.3/=. Total yield: 19 kg (Still yielding in April '80). Market value; Rs.38/=.

Table 12: Chinnathambi's Field

Total Area:	Length 51.2 M, width 19.2 M; Area ≃ 1000 sq.m
	Total labour for preparation: 4 man days
	Total labour for watering 5 man hours (8 times by diesel pump)
	Manure: 9.6 kg urea + 250 kg poultry litter
	Pesticice use: 100 ml demecron
	Neem Leaf extract: 30 litres
	Seed: 2 kg of A. tristis and A.gangeticus
	Total times of harvest: 8 times
	Planting of seed: 5.3.1980
	Harvested on 26, 27, 28, 29 March 1980
	Total yield: 600 kg
	Extrapolated yield: 6 tons/ha in 26 days
	Approximate value Rs.600/=.

SOCIAL WORKER'S REPORT

The Biodynamic Garden method was first tested at the IFIAS - SRD Centre* at Injambakkam and was carefully studied before actually taking the method into the village. The yield data collected from this was highly satisfactory and convincing. Since there was substantial proof to this method, the social workers and the other staff took this very confidently into the village. To begin with, they started looking for people who had a little unused land with fencing. Since they had already established very good rapport with the people, they had no difficulty in spotting out such people and contacting them. Then, four houses were chosen and the Social Workers sat in their houses and convinced them to have biodynamic gardens by explaining the whole method and advantages very clearly to them on the following points:

1. It is nothing but kitchen gardening.
2. More yield in lesser land.
3. Lesser water consumption, use of local manure and people's own labour and effort.
4. Availability of fresh vegetables from their own gardens at the required time.
5. The economic status of the people can be slightly enhanced through biodynamic garden, since they can make a supplementary income by selling the vegetable.
6. Improvement of health and working capacity of the people due to the nutritive value of vegetables from their own houses.

---

*International Federation of Institutes of Advanced Study - Stockholm - Self Reliant Development Project

7. In short, it is a self-reliant project and makes them independant.

The aim of IFIAS to make individuals self-reliant and self-sufficient is achieved through this biodynamic garden. People are made confident to stand on their own legs. Biodynamic garden also helps the people to avoid spending on conveyance to go to the market to purchase the vegetables and at the same time people are not affected by market price fluctuations as they get vegetables in their own houses. Another advantage of the biodynamic garden is clearly depicted from the fact that it encourages the social interaction when people locally market the vegetables at comparatively cheaper rate.

The vegetables grown in these four houses were Greens, Bhendi, Cluster Beans and Brinjals.

The seeds were given free to the people in the beginning just to encourage them to have more gardens. Later, the Centre started charging for the seeds as the people also started realising the importance of participation in IFIAS Projects.

Each family was able to get about Rs.10/= by selling the greens (apart from their own consumption) from a bed of 5' breadth and 12' length for which the investment was Rs.1.50 worth of seeds, 2 baskets of local manure and 15 minutes of labour for watering every day.

As the people were witnessing the immediate effect of these gardens, they were highly satisfied and more and more people started approaching the Centre, for gardens.

This formed a basis for the further development of IFIAS Project. The Centre was identified by the people through these gardens. So, the biodynamic garden programme helped MCRC to win the confidence of the people and encouraged people's participation in IFIAS projects. As the IFIAS project aims at Community Development through appropriate and low cost technology, the Social Workers had to adopt the principles of community organization to organize the people for the developmental projects. According to a principle of community organization a simple programme should be taken up initially to prepare the people, for more and more complex programmes in future. Therefore, biodynamic gardening as a simple programme is preparing the people for complex programmes such as use of windmills, biogas, fish culture, etc.

The Centre extended its gardens from a few families to 22 families in four months. These families were contacted by the staff by making house visits and individual attention was given to each of these families. The family conditions were well analysed and it was found in few houses the non-availability of water was found to be the major problem for not having these gardens. They were also found to be very much interested in these gardens and took them up with great enthusiasm. Hence hand pumps were given to six of such families in which they also had a share (approximately Rs.100 to Rs.200/= each).

Periodic meetings were organized at the Centre with these families and their problems with regard to these

gardens were discussed. Also skits and plays were enacted to bring the significane of vegetable growing to poor people. Follow up work was done and data was collected after one cycle of gardens were harvested. The sample of the data of 11 houses is presented in this report.

Difficulties Faced in the Establishment and Maintenance of these Gardens

1. People could not afford a pucca fencing and hence had to go in for a temp rary one. This could not prevent the goats entering into these gardens.

2. Due to non-availability of water from nearby places, people had problems in watering their gardens.

3. No proper pesticides. IFIAS used neem leaf extract as a pesticide for the plants. But it was effective only for a few kinds of pests and not for all plants.

4. Lack of interest among people, due to their involvement in other occupations, such as illicit liquor production - in the colony was a major impediment in extending these gardens in the colony.

However, IFIAS is still trying to motivate these people and working out their self-realization.

Apart from this method as a kitchen gardening programme the same method was tried in a larger scale in the fields (Kazhani) of one of the villagers by name Chinnathambi. It was also successful and the data is given in Table 12.

To close this report, we can confidently say that these gardens have awakened the people and to-day we see many of them doing biodynamic gardening by themselves without the help of the Centre.

ANALYSIS OF VILLAGE DA.

The data presented in Tables 2-12 are a portion of the 22 gardens established in rural areas. In general the more educated and literate the person, the better he was able to maintain the gardens and understood the value of self-reliant gardening.

Thus Kannappan (Table 11) was not taught the method at all but started off on his own and now has confidence to considerably augment his income with horticulture. He is also sufficiently motivated to keep all his own data in a systematic manner.

Considering the fishing village and the houses of Veeramuthu, Boopalan, and Balammal it can be seen that yields of greens and cluster beans was very good. On an hectare basis, Balammal obtained 13.0 tons/ha of greens (equivalent), Boopalan's wife: 54 tons/ha (equivalent) and Veeramuthu: 33 tons/ha (equivalent)in one bed each till the bed was exhausted.

Undoubtedly the data has high error limits, but still it showed the villagers that even very poor ocean sand could be used fruitfully by people who have had no previous skills in vegetable farming.

The Social Worker's report and the yields obtained here show a promise for this method as a means of propagating self-reliance and confidence. Making the following basic assumptions,

1. Manure has roughly 50% moisture after composting and has an energy value of 2000 kcal/kg dry.

2. Each person spends ½ man day/week/bed of biodynamics some rough energy output, input ratios can be calculated. Thus Nagalingam showed 1:3 (Table 2) and Kannappan (Table 11) showed 1:1 on output/input for Bhendi; i.e. Nagalingam invested more energy than he got out of the system.

Two factors help to smoothen out these harsh findings. (a) The manure invested is a continuing investment and all its nutriments are not necessarily exhausted after one planting, and, (b) Only edible biomass has been accounted for. However it is true that Kannappan is a very motivated, diligent person who watered and maintained his garden much better. Kannappan also obtained the yield equivalent of 15 tons/ha of Bhendi. This is to be compared with 10-12 tons/ha in Table 1, the T.N. State value, even after intensive urea and insecticide usage.

YIELD AND OTHER INFORMATION FROM CLAYEY SOIL

Figures 10, 11, & 12, show the state of beds made in clayey soil. Tables 13, 14, 15, 16, 17, and 18 report data obtained from August 1977 till June 1980. Figure 11 shows thick growth of Bhendi and Figure 12, one of Radish.

The last column in the Tables has allowed for 16% walk-ways/hectare to facilitate comparison with other published data. However it is not known if such data contain allowances for walkways. It can be seen that Bhendi and Ashgourd give about the same yield as commercial agriculture with far less investment of energy. Radish does outstandingly well in total biomass yield in a very short period. Thus taking 7 man-days per bed for the life of the bed (as average) the output/input ratio on total biomass for Radish is roughly 3:1. Other crops contain less edible portions, so for human beings it will not be such a good return. All such cultural energy analysis must be rigorous by checked over a year's cultivation in the same area.

In clayey soil, taking the example of Radish, one can produce by biodynamic gardening roughly 6 crops of Radish, i.e. about 180-200 tons/hectare/year of humanly edible crop.

Table 13: Biodynamic Garden Yield Data - Experiment No.1

Clayey Soil (August - November 1977)

Sl No	Bed No	Name of the vegetable	Spacing in cm	Duration (from date of sowing till last harvest in days)	Total yield in kg/bed 9.31 sq.m	kg/ha not including walk-ways	Total yield/ha including walk-ways of about 16% area kg/ha
1	1	Bhendi	25	Not Available	8.3	8915.14	8842
2	1	Cluster Beans (companion)	25		1.5	1611.17	
3	2	Pumpkin	50		25.0	26852.85	25443
4	2	Ashgourd (companion)	50		3.2	3437.16	

Note: Experiment was spoiled due to cyclonic weather and water logging in beds during October/November 1977

Table 14: Biodynamic Garden Yield Data - Experiment No.2

Clayey Soil (January - April 1978)

Sl No	Bed No	Name of the vegetable	Spacing in cms	Duration (from date of sowing till last in days)	Total yield in kg/bed 9.31 sq. m.	kg/ha not including walk-ways	Total yield/ha including walk-ways (about 16% area)
1	1	Bhendi	25	95	8.3	8950.14	8871
2	1	Cluster Beans	25	80	1.5	1611.17	
3	2	Ashgourd	50	53	25.0	26852.84	25443
4	2	Pumpkin	50	65	3.2	3437.16	
5	3	Brinjal	15	70	9.4	10096.66	10736
6	3	Chillies	15	38	2.5	2685.28	
7	4	Brinjal	15	74	11.8	12674.55	16136
8	4	Tomato	15	95	6.0	6444.68	
9	5	Bhendi	15	84	9.3	9989.26	16240
10	5	Radish	15	37x40	8.7	9344.79	
11	6	Tomato	15	95	19.6	21052.63	18586
12	6	Radish	15	37	1.0	1074.11	
13	7	Tomato	15	98	21.0	22556.39	19850
14	7	Radish	15	37	1.0	1074.11	
15	8	Water Melon	50	110	50.0	53705.09	45112

Note: All beds sown on 26.8.78; Neem leaf extract sprayed 9 to 10 times against insects, pests; (2) Pyrethrum was also sprayed. Biogas effluent was sprayed on 1:1 dilution on alternate days for 30 days

Table 15: Biodynamic Garden Yield Data - Experiment No.3

Clayey Soil (January - June 1979)

Sl No	Bed No	Name of the vegetable	Spacing in cms	Duration (from date of sowing till last harvest in days	Total yield in kg/bed 9.31sq.m	kg/ha not including walk ways	Total yield/ha including walk ways (about 16% area)
1	1	Radish	7.50	38&48	51.7	55531.69	49227
2	1	Cluster Beans	7.50	95	2.86	3071.97	
3	2	Bhendi	15.00	95	8.82	9473.68	7957
4	2	French Beans	15.00	-	*	*	
5	3	Bhendi	15.00	95	9.24	9924.81	10321
6	3	Onion	15.00	81	2.20	2363.05	
7	4	Onion	15.00	81	2.30	2470.46	9599
8	4	Cluster Beans	15.00	95	8.34	8958.11	
9	5	Onion	30.00	81	1.15	1235.23	35323
10	5	Radish	30.00	41	38.00	40816.33	
11	6	Ashgourd	60.00	85	14.50	15574.65	30675
12	6	Water Melon	60.00	98	19.50	20945.22	
13	7	Cucumber	60.00	97	25.74	27648.52	25470
14	7	Ribbed gourd	60.00	76	2.49	2674.62	
15	8	Summer Squash	60.00	90	19.48	20923.74	17575
16	8	Water Melon	60.00	-	-	no yield	

* French bean did not survive

Table 16: Biodynamic Garden Yield Data - Experiment No.4

Clayey Soil (Date of planting: 3rd February 1980)

Sl No	Bed No	Name of the vegetable	Spacing in cms	Duration (From date of sowing till last harvest in days)	Total yield in kg/bed 9.31sq.m	kg/ha not including walk-ways	Total yield/ha including walk ways (about 16% area) - kgs/ha
1	1	Bhendi	20	60	7.46	8012.88	31993
2	1	Chillies(½ bed)	20	29	*	*	
3	1	Radish(½ med)	20	37	28.00**	30075.19	
4	2	Tomato	20	90	15.730	16895.81	25469
5	2	Radish(companion)	20	37	12.50	13426.42	
6	3	Brinjal	20	74	17.265	18544.58	15983
7	3	Onion(companion)	20	94	0.450	483.35	
8	4	Bhendi(companion)	20	60	4.40	4726.10	21302
9	4	Tomato	20	90	19.21	20633.73	
10	5	Cucumber(companion)	30	60	4.23	4543.50	11331
11	5	Ribbed gourd	30	84	8.33	8947 .37	
12	6	Tomato	20	90	19.805	21272.82	17869

* Chillies did not survive due to transplantation shock

** Yield mentioned is for ½ the bed

Note: Neem leaf extract was sprayed for about 10 times at the time of yield to the last yield as prophylactic spray against pests.

Amount of compost used = 2.25 qtls

Table 17: Biodynamic Garden Yield Data - Experiment No.4

Daily harvest data

Date	Bed I	Bed II	Bed III	Bed IV	Bed V	Bed VI
13.3.80	28 kg Radish	12.5 kg Radish				
15.3.80	0.360kg Bhendi			0.650kg Bhendi		
17.3.80	0.450kg Bhendi	0.120kg Tomato	1.450kg Brinjal	0.650kg Bhendi		
20.3.80	0.340kg Bhendi	0.340kg Tomato	2.00kg Brinjal	0.500kg Bhendi 0.120kg Tomato	0.300kg Cuc. 0.240kg R.G.	
24.3.80	0.700kg Bhendi	0.800kg Tomato	2.250kg Tomato	1.045kg Bhendi 0.650kg Tomato	0.220kg R.G.	0.345kg Tomato
27.3.80	0.450kg Bhendi	0.760kg Tomato	1.435kg Brinjal	1.830kg Tomato 0.650kg Bhendi	1.660kg R.G. 0.330kg Cuc.	1.004kg Tomato
1.4.80	0.650kg Bhendi	2.150kg Tomato	3.750kg Brinjal	2.00kg Tomato 0.380kg Bhendi	2.050kg R.G. 0.850kg Cuc.	2.7kg Tomato
3.4.80	0.250kg Bhendi	2.150kg Tomato	1.350kg Brinjal	2.050kg Tomato 0.150kg Bhendi	2.00kg R.G. 0.050kg Cuc.	1.050kg Tomato
5.4.80		2.2kg Tomato		2.9kg Tomato		3.850kg Tomato
7.4.80	0.250kg Bhendi	1.670kg Tomato	1.180kg Brinjal	3.020kg Tomato	0.480kg R.G.	4.150kg Tomato
9.4.80	0.100kg Bhendi	1.600kg Tomato	0.700kg Brinjal	2.00kg Tomato	6.250kg Cuc.	2.00kg Tomato

11.4.80	0.150kg Bhendi	0.800kg Tomato	0.400kg Brinjal	1.00kg Tomato	0.300kg R.G.	1.5kg Tomato
14.4.80		0.5kg Tomato	0.800kg Brinjal	1.3kg Tomato	0.500kg R.G.	0.850kg Tomato
17.4.80		0.650kg Tomato	0.750kg Brinjal	1.350kg Tomato	0.550kg R.G.	0.600kg Tomato
21.4.80		1.100kg Tomato	0.200kg Brinjal	0.800kg Tomato		0.750kg Tomato
29.4.80		0.800kg Tomato	1.00kg Brinjal	0.400kg Tomato	0.550kg R.G.	0.600kg Tomato
2.5.80		1.450kg Tomato	0.450kg Onion	0.500kg Tomato		0.600kg Tomato